



DEFENSE INFORMATION SYSTEMS AGENCY

P. O. BOX 4502
ARLINGTON, VIRGINIA 22204-4502

IN REPLY

REFER TO: Battlespace Communications Portfolio (JTE)

22 July 2008

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

References: (a) DoD Directive 4630.5, "Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)," 5 May 2004
(b) CJCSI 6212.01D, "Interoperability and Supportability of Information Technology and National Security Systems," 8 March 2006
(c) through (e), see enclosure 1

1. References (a) and (b) establish the Defense Information Systems Agency (DISA), Joint Interoperability Test Command (JITC), as the responsible organization for interoperability test certification.

2. The Cisco ASLAN and non-ASLAN with Specified Software Releases is hereinafter referred to as the system under test (SUT). The SUT meets all of its critical interoperability requirements and is certified as interoperable for joint use within the Defense Switched Network (DSN). The ASLAN, formerly known as the Assured Services Voice Application Local Area Network (ASVALAN), is certified to support DSN Assured Services over Internet Protocol. The SUT components which are bolded and underlined in the tables throughout this certification letter are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined, but also listed throughout the tables in this letter, are certified for joint use in the DSN as well. The JITC analysis determined these components contain the same hardware and software and are functionally identical to the tested components for interoperability certification purposes. If a system meets the minimum requirements for an ASLAN, it also meets the lesser requirements for a non-ASLAN. The non-ASLAN, formerly known as a Voice Application Local Area Network (VALAN) does not support the Assured Services Requirements detailed in reference (c), Command and Control (C2) users and Special C2 users are not authorized to be served by a non-ASLAN. Since non-ASLANs do not support Assured Services, they can only serve Department of Defense (DoD), non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. Non-ASLAN connectivity to the DSN is not authorized until a waiver is granted by the Joint Staff for each site. The SUT is certified for joint use as a non-ASLAN for non-C2 traffic. The non-ASLAN requirements differing from those of an ASLAN include:

- C2 traffic shall not traverse a non-ASLAN.
- Reliability is a conditional requirement for a non-ASLAN.

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

- Network Management features are conditional requirements for a non-ASLAN.

Testing did not include video services or data applications; however, simulated data traffic was generated during testing to determine its effect on voice traffic. No other configurations, features, or functions, except those cited within this report, are certified by the JITC, or authorized by the Program Management Office for use within the DSN. This certification expires upon changes that could affect interoperability, but no later than three years from the date of this memorandum.

3. This finding is based on interoperability testing conducted by JITC and a review of the vendor's Letters of Compliance (LoC). Testing was conducted at JITC's Global Information Grid Network Test Facility at Fort Huachuca, Arizona, from 14 January through 21 March 2008. Review of the vendor's LoC was completed on 28 April 2008. Enclosure 2 documents the test results and describes the tested network.

4. The overall interoperability status of the SUT is indicated in table 1. The ASLAN and non-ASLAN system requirements are listed in table 2. In addition to system level requirements, components that comprise the SUT must meet specific criteria to be certified for use as core, distribution, or access components. The interoperability status of the SUT components is listed in table 3. The ASLAN and non-ASLAN requirements used to certify the components are listed in table 4. This interoperability test status is based on the SUT's ability to meet:

- a. Assured Services as defined in reference (c).
- b. Local Area Network system requirements specified in reference (d) verified through JITC testing and/or vendor submission of LoC.
- c. Internet Protocol version 6 requirements specified in reference (d), paragraph 1.7, table 1-4, verified through vendor submission of LoC signed by the Vice President of the company.
- d. The overall system interoperability performance derived from test procedures listed in reference (e).

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 1. SUT Interoperability Status

System Interoperability Status			
Components (See note 1.)	Release	Status	Remarks
WS-C6503, WS-C6503-E, WS-C6504, WS-C6504-E, WS-C6506, WS-C6506-E, <u>WS-C6509</u> , <u>WS-C6509-E</u> , WS-C6509-NEB, WS-C6509-NEB-A, WS-C6513	IOS 12.2 (33) SXH	Certified	All ASLAN and non-ASLAN system requirements were met when the SUT was configured in accordance with architecture provided in enclosure 2. Additional details about component level certification are provided in table 3. Security testing is accomplished through DISA-led Information Assurance Test teams and published in a separate report.
<u>ME-C6524GS-8S</u> , ME-C6524GT-8S	IOS 12.2 (33) SXH		
WS-C4503 ² , WS-C4503-E ² , WS-C4506 ² , WS-C4506-E ² , <u>WS-C4507R</u> , <u>WS-C4507R-E</u> , WS-C4510R, WS-C4510R-E	IOS 12.2 (40) SG		
WS-C3750G-24T-S, WS-C3750G-24T-E, WS-C3750G-24TS-S, WS-C3750G-24TS-E, WS-C3750G-24TS-S1U, WS-C3750G-24TS-E1U, <u>WS-C3750G-24PS-S</u> , WS-C3750G-24PS-E, WS-C3750G-48TS-E, WS-C3750G-48PS-S, WS-C3750G-48PS-E, WS-C3750G-12S-S, WS-C3750G-12S-SD, <u>WS-C3750G-12S-E</u> , WS-C3750E-24TD-E, <u>WS-C3750-24FS-S</u> , WS-C3750-24PS-S, WS-C3750-24PS-E, WS-C3750-24TS-S, WS-C3750-24TS-E, WS-C3750-48PS-S, <u>WS-C3750-48PS-E</u> , WS-C3750-48TS-S, WS-C3750-48TS-E	IOS 12.2 (40) SE		
WS-C3750E-24TD-S, WS-C3750E-24TD-E, WS-C3750E-48TD-S, WS-C3750E-48TD-E, WS-C3750E-24PD-S, <u>WS-C3750E-24PD-E</u> , WS-C3750E-48PD-S, <u>WS-C3750E-48PD-E</u> , WS-C3750E-48PD-SF, WS-C3750E-48PD-EF	IOS 12.2 (40) SE		
WS-C3560G-48PS-S, <u>WS-C3560G-48PS-E</u> , WS-C3560G-24PS-S, WS-C3560G-24PS-E, WS-C3560G-48TS-S, WS-C3560G-48TS-E, WS-C3560G-24TS-S, WS-C3560G-24TS-E, <u>WS-C3560-8PC-S</u> , WS-C3560-48PS-S, WS-C3560-48PS-E, WS-C3560-24PS-S, WS-C3560-24PS-E, WS-C3560-48TS-S, WS-C3560-48TS-E, WS-C3560-24TS-S, WS-C3560-24TS-E	IOS 12.2 (40) SE		
WS-C3560E-24TD-S, WS-C3560E-24TD-E, WS-C3560E-48TD-S, WS-C3560E-48TD-E, WS-C3560E-24PD-S, WS-C3560E-24PD-E, WS-C3560E-48PD-S, <u>WS-C3560E-48PD-E</u> , WS-C3560E-48PD-SF, WS-C3560E-48PD-EF	IOS 12.2 (40) SE		
WS-C2960-8TC-L, WS-C2960-24TC-L, WS-C2960-24TT-L, WS-C2960-48TC-L, WS-C2960-48TT-L, <u>WS-C2960G-8TC-L</u> , WS-C2960G-24TC-L, WS-C2960G-48TC-L, WS-C2960-24-S, WS-C2960-24TC-S, WS-C2960-48TC-S, WS-C2960PD-8TT-L	IOS 12.2 (40) SE		
LEGEND: ASLAN - Assured Services Local Area Network DISA - Defense Information Systems Agency DSN - Defense Switched Network E - Enhanced IOS - Internetwork Operating System JITC - Joint Interoperability Test Command ME - Metro Ethernet NEB - Network Equipment Building SUT - System Under Test SE - System Engineering UCR - Unified Capabilities Requirements WS - Workgroup Switch			
NOTES: 1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use. 2 Indicates these switches support one processor and must be configured to failover to a redundant distribution switch. 3 Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch after a processor failover, only the “auto qos voip trust” access port command is certified. The Cisco proprietary “auto qos cisco-phones” command is not authorized nor approved for use within the DSN.			

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 2. ASLAN and non-ASLAN System Requirements

System Requirements				
Requirement	Criteria		UCR Paragraph	Required
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		A3.3.2.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		A3.3.2.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		A3.3.2.3	Yes
Network Management	LAN Network Management Interface. One of the following methods: In-band, or Out-of-band		A3.3.7.1	Yes
	LAN Configuration Control		A3.3.7.2	Yes
	LAN Operational Changes		A3.3.7.3	Yes
	LAN Performance Monitoring		A3.3.7.4	Yes
	LAN Alarms		A3.3.7.5	Yes
	LAN Reporting		A3.3.7.6	Yes
Availability	ASLAN	99.999% Availability	A3.3.9.2	Yes
	non-ASLAN	99.9% Availability	A3.3.9.2	Yes
Redundancy	ASLAN	No Single Point of Failure that can cause an outage of more than 64 IP telephony subscribers	A3.3.9.3	Yes
	non-ASLAN	No Single Point of Failure that can cause an outage of more than 64 IP telephony subscribers	A3.3.9.3	No
Survivability	ASLAN	Service continuity in the presence of faults within the network	A3.3.9.4	Yes
	non-ASLAN	Service continuity in the presence of faults within the network	A3.3.9.4	No
Traffic Engineering	Voice bandwidth not to exceed 25 percent of available bandwidth, ITU-T G.711 codec with 20ms sample size.		A3.3.9.6	Yes
IPv6	All IP devices shall be IPv6 capable.		1.7 and A3.2.8	Yes
Security	DIACAP/IA (See note.)		A3.3.8	Yes
LEGEND: ASLAN - Assured Services LAN DIACAP - Department of Defense Information Assurance Certification and Accreditation Process DISA - Defense Information Systems Agency G.711 - PCM of voice frequencies IA - Information Assurance IP - Internet Protocol IPv6 - Internet Protocol version 6 ITU-T - International Telecommunication Union - Telecommunication Standardization Sector LAN - Local Area Network ms - milliseconds PCM - Pulse Code Modulation UCR - Unified Capabilities Requirements				
NOTE: Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.				

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 3. SUT Component Interoperability Status

Component Interoperability Status					
Component (See note 1.)	Release	Sub-component (See note 1.)	Status	Layer (s)	Remarks
WS-C6503, WS-C6503-E, WS-C6504, WS-C6504-E, WS-C6506, WS-C6506-E, <u>WS-C6509</u> , <u>WS-C6509-E</u> , WS-C6509-NEB, WS-C6509-NEB-A, WS-C6513,	IOS 12.2 (33) SXH	WS-SUP720-3B	Certified	Core, Distribution, Access	All CRs and FRs were met.
		WS-SUP720	Certified		
		<u>WS-SUP720-3BXL</u>	Certified		
		<u>WS-SUP32-GE-3B</u>	Certified		
		WS-SUP32-10GE-3B	Certified		
		<u>WS-X6148-RJ45V</u>	Certified		
		WS-X6148-RJ-45	Certified		
		WS-X6148-RJ-21	Certified		
		WS-X6148-R21V	Certified		
		<u>WS-X6148-45AF</u>	Certified		
		WS-X6148-21AF	Certified		
		<u>WS-X6708-10G-3CXL</u>	Certified		
		<u>WS-X6148X2-45AF</u>	Certified		
		<u>WS-X6148-FE-SFP</u>	Certified		
		<u>WS-X6704-10GE</u>	Certified		
		<u>WS-X6816-GBIC</u>	Certified		
		<u>WS-X6708-10GE</u>	Certified		
		<u>WS-X6148V-GE-TX</u>	Certified		
		WS-X6148-GE-TX	Certified		
		<u>WS-X6148-GE-45AF</u>	Certified		
		<u>WS-X6148A-GE-45AF</u>	Certified		
		WS-X6148A-GE-TX	Certified		
		WS-X6148A-RJ-45	Certified		
		WS-X6148A-45AF	Certified		
		<u>WS-X6348-RJ45V</u>	Certified		
		WS-X6348-RJ45	Certified		
		WS-X6348-RJ21V	Certified		
		WS-X6516-GE-TX	Certified		
		<u>WS-X6516-GBIC</u>	Certified		
		<u>WS-X6516A-GBIC</u>	Certified		
		<u>WS-X6548V-GE-TX</u>	Certified		
		<u>WS-X6548-GE-TX</u>	Certified		
		WS-X6548-RJ-21	Certified		
		WS-X6548-RJ-45	Certified		
		WS-X6548-GE-45AF	Certified		
		<u>WS-X6816-GBIC</u>	Certified		
		<u>WS-X6748-SFP</u>	Certified		
		WS-X6724-SFP	Certified		
		WS-X6748-GE-TX	Certified		
		WS-X6708-10G-3C	Certified		
		WS-X6148X2-RJ-45	Certified		
		WS-X6196-RJ-21	Certified		
		WS-X6196-21AF	Certified		
<u>ME-C6524GS-8S</u> , ME-C6524GT-8S	IOS 12.2 (33) SXH	Not Applicable	Certified	Core, Distribution, Access	All CRs and FRs were met.

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 3. SUT Component Interoperability Status

Component (See note 1.)	Release	Sub-component (See note 1.)	Status	Layer (s)	Remarks
WS-C4503 ² , WS-C4503-E ² , WS-C4506 ² , WS-C4506-E ² , <u>WS-C4507R</u> , <u>WS-C4507R-E</u> , WS-C4510R, WS-C4510R-E	IOS 12.2 (40) SG	<u>WS-X4516-10GE (Sup V)</u>	Certified	Core, Distribution, Access	All CRs and FRs were met.
		WS-X4516 (Sup V)	Certified		
		<u>WS-X4013+10GE</u>	Certified		
		WS-X4013+	Certified		
		<u>WS-X4306-GB</u>	Certified		
		WS-X4302-GB	Certified		
		WS-X4506-GB-T	Certified		
		<u>WS-X4148-RJ45V</u>	Certified		
		WS-X4124-RJ45	Certified		
		WS-X4148-RJ45	Certified		
		WS-X4148-RJ21	Certified		
		<u>WS-X4148-FX-MT</u>	Certified		
		WS-X4124-FX-MT	Certified		
		WS-X4248-FE-SFP	Certified		
		WS-X4148-FE-BD-LC	Certified		
		WS-X4148-FE-LX-MT	Certified		
		<u>WS-X4232-GB-RJ</u>	Certified		
		WS-X4232-RJ-XX	Certified		
		<u>WS-X4248-RJ45V</u>	Certified		
		WS-X4248-RJ21V	Certified		
		WS-X4224-RJ45V	Certified		
		<u>WS-X4548-GB-RJ45V</u>	Certified		
		<u>WS-X4548-GB-RJ45</u>	Certified		
		WS-X4524-GB-RJ45V	Certified		
		WS-X4448-GB-RJ45	Certified		
		WS-X4424-GB-RJ45	Certified		
		<u>WS-X45-SUP6-E</u>	Certified		
		WS-X45-SUP6-E/2	Certified		
		WS-X4648-RJ45V-E	Certified		
		<u>WS-X4606-X2-E</u>	Certified		
		<u>WS-X4648-RJ45V+E</u>	Certified		
		WS-X4648-RJ45V-E	Certified		
WS-C3750G-24T-S, WS-C3750G-24T-E, WS-C3750G-24TS-S, WS-C3750G-24TS-E, WS-C3750G-24TS-S1U, WS-C3750G-24TS-E1U, <u>WS-C3750G-24PS-S</u> , WS-C3750G-24PS-E, WS-C3750G-48TS-E, WS-C3750G-48PS-S, WS-C3750G-48PS-E, WS-C3750G-12S-S, WS-C3750G-12S-SD, <u>WS-C3750G-12S-E</u> , WS-C3750E-24TD-E, <u>WS-C3750-24FS-S</u> , WS-C3750-24PS-S, WS-C3750-24PS-E, WS-C3750-24TS-S, WS-C3750-24TS-E, WS-C3750-48PS-S, <u>WS-C3750-48PS-E</u> , WS-C3750-48TS-S, WS-C3750-48TS-E	IOS 12.2 (40) SE	Not Applicable	Certified	Distribution, Access	All CRs and FRs were met. See note 3.
WS-C3750E-24TD-S, WS-C3750E-24TD-E, WS-C3750E-48TD-S, WS-C3750E-48TD-E, WS-C3750E-24PD-S, <u>WS-C3750E-24PD-E</u> , WS-C3750E-48PD-S, <u>WS-C3750E-48PD-E</u> , WS-C3750E-48PD-SF, WS-C3750E-48PD-EF	IOS 12.2 (40) SE	Not Applicable	Certified	Access	All CRs and FRs were met. See note 3.

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 3. SUT Component Interoperability Status

Component (See note 1.)	Release	Sub-component (See note 1.)	Status	Layer (s)	Remarks
WS-C3560G-48PS-S, <u>WS-C3560G-48PS-E</u> , WS-C3560G-24PS-S, WS-C3560G-24PS-E, WS-C3560G-48TS-S, WS-C3560G-48TS-E, WS-C3560G-24TS-S, WS-C3560G-24TS-E, <u>WS-C3560-8PC-S</u> , WS-C3560-48PS-S, WS-C3560-48PS-E, WS-C3560-24PS-S, WS-C3560-24PS-E, WS-C3560-48TS-S, WS-C3560-48TS-E, WS-C3560-24TS-S, WS-C3560-24TS-E	IOS 12.2 (40) SE	Not Applicable	Certified	Access	All CRs and FRs were met.
WS-C3560E-24TD-S, WS-C3560E-24TD-E, WS-C3560E-48TD-S, WS-C3560E-48TD-E, WS-C3560E-24PD-S, WS-C3560E-24PD-E, WS-C3560E-48PD-S, <u>WS-C3560E-48PD-E</u> , WS-C3560E-48PD-SF, WS-C3560E-48PD-EF	IOS 12.2 (40) SE	Not Applicable	Certified	Access	All CRs and FRs were met.
WS-C2960-8TC-L, WS-C2960-24TC-L, WS-C2960-24TT-L, WS-C2960-48TC-L, WS-C2960-48TT-L, <u>WS-C2960G-8TC-L</u> , WS-C2960G-24TC-L, WS-C2960G-48TC-L, WS-C2960-24-S, WS-C2960-24TC-S, WS-C2960-48TC-S, WS-C2960PD-8TT-L	IOS 12.2 (40) SE	Not Applicable	Certified	Access	All CRs and FRs were met.
LEGEND: CRs - Capability Requirements E - Enhanced FRs - Feature Requirements FX-MT - Foreign Exchange, ATM Term GB - Gigabit GBIC IOS - Internetwork Operating System JITC - Joint Interoperability Test Command L2 - Layer 2 L3 - Layer 3 ME - Metro Ethernet NEB - Network Equipment Building RJ - Registered Jack S - Standard SFP - Small Form Factor Pluggable SUP - Supervisor SUT - System Under Test TX - The designation of a copper RJ-45 connection for Fast Ethernet WS - Workgroup Switch					
NOTES: 1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use. 2 Indicates these switches support one processor and must be configured to failover to a redundant distribution switch. 3 Due to a tagging problem with L2 and L3 on the Catalyst 3750 switch, after a processor failover, only the "auto qos voip trust" access port command is certified. The Cisco proprietary "auto qos cisco-phones" command is not authorized nor approved for use within the DSN by the Program Management Office.					

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Table 4. ASLAN and non-ASLAN Component Requirements

Core/Distribution/Access Component Requirements				
Requirement	Criteria		UCR Paragraph	Required
Traffic Prioritization	Traffic within LAN components shall be prioritized by session media type in accordance with the NCIDs.		A3.3.3	Yes
Traffic Priority Method	LAN components shall support DSCP, and IEEE 802.1p to DSCP mapping.		A3.3.3.1	Yes
Queuing	LAN components shall support one of the following: - Priority Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing		A3.3.4.1	Yes
	LAN components shall be capable of - four hardware queues (Expedited Forwarding, Assured Forwarding, Assured Forwarding Preferred, and Default) - Assigning any “tagged” session to any hardware queues		A3.3.4.1	Yes
LAN Behaviors	LAN components shall support Differential Service Per-Hop Behaviors per RFCs 2474, 2475, and 3260		A3.3.4.2	Yes
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Shall be capable of reassigning VLAN IDs - Accepting VLAN tagged frames in accordance with IEEE 802.1Q		A3.3.5	Yes
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol - IEEE 802.3af - Power over Ethernet (Conditional)		A3.3.9.1	Yes
Single Device Redundancy	ASLAN	LAN components shall support: - ASLAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 users) - N+1 sparing for access (more than 64 users) - Redundancy protocol ¹ - 2 second path restoral - No single point of failure will cause loss of more than 64 users	A3.3.9.3.1	Yes
	non-ASLAN	This requirement is conditional for a non-ASLAN.	A3.3.9.3.1	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs. ²		A3.3.8	Yes
IPv6	All IP devices shall be IPv6 capable.		1.7 and A3.2.8	Yes
LEGEND: 802.1d - Standard for Local and Metropolitan Area Networks: MAC Bridges 802.1p - LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization 802.1Q - Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks 802.1s - Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees 802.1v - Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition) 802.1w - Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration 802.1x - Standard for Local and Metropolitan Area Networks Port-Based Network Access Control 802.3ad - Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: CSMA/CD Access Method and Physical Layer Specifications– Aggregation of Multiple Link Segments 802.3af - Standard for CSMA/CD Access Method and Physical Layer Specifications - Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) ASLAN - Assured Services LAN CoS - Class of Service CSMA/CD - Carrier Sense Multiple Access with Collision Detection DISA - Defense Information Systems Agency DSCP - Differentiated Services Code Point IEEE - Institute of Electrical and Electronics Engineers ID - Identification IP - Internet Protocol IPv6 - Internet Protocol version 6 LAN - Local Area Network MAC - Media Access Control NCID - Net-Centric Implementation Document N - total VoIP users / 64 OSPF - Open Shortest-Path First QoS - Quality of Service RFC - Request for Comment SNMP - Simple Network Management Protocol STIGs - Security Technical Implementation Guides UCR - Unified Capabilities Requirements VLANs - Virtual LANs VoIP - Voice over Internet Protocol VRRP - Virtual Router Redundancy Protocol				
NOTES: 1 For core and distribution components, OSPF redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol. 2 Security is tested by DISA-led Information Assurance test teams and published in a separate report.				

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

5. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <https://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.

6. The JITC point of contact is Mr. Edward Mellon, DSN 879-5159, commercial (520) 538-5159, FAX DSN 879-4347, or e-mail to Edward.Mellon@disa.mil. The JITC's mailing address is P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The tracking number for the SUT is 0716902.

FOR THE COMMANDER:

2 Enclosures a/s



RICHARD A. MEADOR

Chief

Battlespace Communications Portfolio

JITC Memo, JTE, Special Interoperability Test Certification of the Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases

Distribution:

Joint Staff J6I, Room 1E596, Pentagon, Washington, DC 20318-6000

Joint Interoperability Test Command, Liaison, ATTN: TED/JT1, 2W24-8C, P.O. Box 4502, Falls Church, VA 22204-4502

Defense Information Systems Agency, Net-Centricity Requirements and Assessment Branch, ATTN: GE333, Room 244, P.O. Box 4502, Falls Church, VA 22204-4502

Office of Chief of Naval Operations (N71CC2), CNO N6/N7, 2000 Navy Pentagon, Washington, DC 20350

Headquarters U.S. Air Force, AF/XICF, 1800 Pentagon, Washington, DC 20330-1800

Department of the Army, Office of the Secretary of the Army, CIO/G6,

ATTN: SAIS-IOQ, 107 Army Pentagon, Washington, DC 20310-0107

U.S. Marine Corps (C4ISR), MARCORSYSCOM, 2200 Lester St., Quantico, VA 22134-5010

DOT&E, Net-Centric Systems and Naval Warfare, 1700 Defense Pentagon, Washington, DC 20301-1700

U.S. Coast Guard, CG-64, 2100 2nd St. SW, Washington, DC 20593

Defense Intelligence Agency, 2000 MacDill Blvd., Bldg 6000, Bolling AFB, Washington, DC 20340-3342

National Security Agency, ATTN: DT, Suite 6496, 9800 Savage Road, Fort Meade, MD 20755-6496

Director, Defense Information Systems Agency, ATTN: GS235, Room 5W24-8A, P.O. Box 4502, Falls Church, VA 22204-4502

Office of Assistant Secretary of Defense (NII)/DoD CIO, Crystal Mall 3, 7th Floor, Suite 7000, 1851 S. Bell St., Arlington, VA 22202

Office of Under Secretary of Defense, AT&L, Room 3E144, 3070 Defense Pentagon, Washington, DC 20301

U.S. Joint Forces Command, J68, Net-Centric Integration, Communications, and Capabilities Division, 1562 Mitscher Ave., Norfolk, VA 23551-2488

Defense Information Systems Agency (DISA), ATTN: GS23 (Mr. McLaughlin), Room 5W23, 5275 Leesburg Pike (RTE 7), Falls Church, VA 22041

ADDITIONAL REFERENCES

- (c) Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01C, "Policy for Department of Defense Voice Services with Real Time Services (RTS)," 9 November 2007
- (d) Defense Information Systems Agency, "Department of Defense Networks Unified Capabilities Requirements," 21 December 2007
- (e) Joint Interoperability Test Command, "Defense Switched Network Generic Switch Test Plan (GSTP), Change 2," 2 October 2006

CERTIFICATION TESTING SUMMARY

1. SYSTEM TITLE. Cisco Assured Services Local Area Network (ASLAN) and non-ASLAN with Specified Software Releases are hereinafter referred to as the system under test (SUT).

2. PROPONENT. White House Communications Agency (WHCA).

3. PROGRAM MANAGER. Lt Col Alain L. M. Jones, WHCA/J5, 2743 Defense Blvd, Anacostia Annex, District of Columbia, 20373, e-mail: ALJones@whmo.mil.

4. TESTER. Joint Interoperability Test Command (JITC), Fort Huachuca, Arizona.

5. SYSTEM UNDER TEST DESCRIPTION. The SUT is used to transport voice signaling and media as part of an overall Voice over Internet Protocol (VoIP) system. All of the SUT switches provide availability, security, and Quality of Service (QoS) to meet the operational requirements of the network and Assured Services for the warfighter. The SUT components which are bolded and underlined in the tables throughout this certification letter, are components that were tested in the JITC laboratory for this certification. The SUT components which are not bolded and not underlined, but also listed throughout the tables in this letter, were determined by JITC analysis to contain the same hardware and software as, and to be functionally identical to, the tested components for interoperability certification purposes. The ASLAN, formerly known as the Assured Services Voice Application Local Area Network (ASVALAN), is certified to support Defense Switched Network (DSN) Assured Services over Internet Protocol (IP).

The SUT is composed of the following components:

The Catalyst 6500 and 6500-E series delivers scalable performance and port density across several chassis configurations. The Catalyst 6500 series is available in 3-, 4-, 6-, 9-, and 13-slot chassis. The Catalyst 6500 series features a range of integrated services modules, including 10-gigabit fiber cards, 1-gigabit fiber cards, 100-megabit fiber cards, 1-gigabit Small Form-Factor Pluggable (SFP) cards, 10/100BaseT cards and 10/100/1000BaseT Megabits per second (Mbps) switchblades used as access points. For data and voice applications, users can connect to the Local Area Network (LAN) using any Ethernet interface on the access devices.

The Catalyst ME 6524 is a multilayer switch that provides high availability, QoS, and security to enhance network operations in two configurations. The Cisco Catalyst ME-C6524GS-8S provides 24+8 1-gigabit/100-megabit SFP ports. The Catalyst ME-C6524GT-8S provides 24 10/100/1000BaseT and 8 1-gigabit/100-megabit SFP ports.

The 4500 and 4500-E series are available in a multi-slot chassis for 10-gigabit fiber cards, 1-gigabit fiber cards, 100-megabit fiber cards, 10/100BaseT cards and 10/100/1000BaseT Mbps access ports to the LAN. This framework allows for a

redundant architecture to ensure no single point of failure for hardware operations. Some slots are reserved for special functions such as supervisor engines. Most slots can be configured for specific user needs. All line card capabilities including bandwidth, throughputs, and routing are dependent on the supervisor engine.

The Catalyst 3750 series utilizes stackable components to provide a redundant architecture. Each switch utilizes 32-Gigabits per second (Gbps) interconnect cables on the back of each switch to connect up to nine stackable switches. Each switch contains a single power supply and processor. The 3750 stackable switches enable flexibility in creating a scalable switching platform with a variety of switching options including 12 1-Gigabit Ethernet fiber SFP port switch, a 24 10/100/1000BaseT port with 4 SFP port switch, and a 48 10/100BaseT port with 4 SFP port switch.

The Catalyst 3750-E series utilizes stackable components to provide a redundant architecture. Each switch utilizes 64-Gigabits per second (Gbps) interconnect cables on the back of each switch to connect up to nine stackable switches. Each switch contains a single power supply and processor. The 3750-E stackable switches enable flexibility in creating a scalable switching platform with a variety of switching options including a 24 10/100/1000BaseT port with 4 1-gigabit SFP or 2 10-gigabit X2 port switch, and a 48 10/100BaseT port with 4 1-gigabit SFP or 2 10-gigabit X2 port switch.

The Cisco Catalyst 3560G series is a multilayer switch that provides high availability, QoS, and security to enhance network operations. The Cisco Catalyst 3560G series provides 24 or 48 10/100/1000BaseT ports and 2 1000BaseX ports.

The Cisco Catalyst 3560 series is a multilayer switch that provides high availability, QoS, and security to enhance network operations. The Cisco Catalyst 3560 series provides 8, 24 or 48 10/100 ports and 1 or 2 1000baseX ports.

The Cisco Catalyst 3560-E series is a multilayer switch that provides high availability, QoS, and security to enhance network operations. The Cisco Catalyst 3560-E series provides 24 or 48 10/100/1000 ports and 4 SFP or 2 10-gigabit ports.

The Cisco Catalyst 2960 series is a layer 2 switch that provides high availability, QoS, and security to enhance network operations. The Cisco Catalyst 2960 series provides 24 or 48 10/100-megabit ports, 8, 24, or 48 10/100/1000-megabit ports and 1 or 2 1000baseX ports.

6. OPERATIONAL ARCHITECTURE. The DSN architecture is a two-level network hierarchy consisting of DSN backbone switches and Service/Agency installation switches. Service/Agency installation switches have been authorized to extend voice services over IP infrastructures. The Unified Capabilities Requirements (UCR) operational DSN Architecture is depicted in figure 2-1, which depicts the relationship of the ASLAN and non-ASLAN to the DSN switch types. The installation ASLAN VoIP architecture is depicted in figure 2-2 and the non-ASLAN VoIP architecture is depicted

in figure 2-3. The ASLAN and non-ASLAN combined VoIP architecture is depicted in figure 2-4.

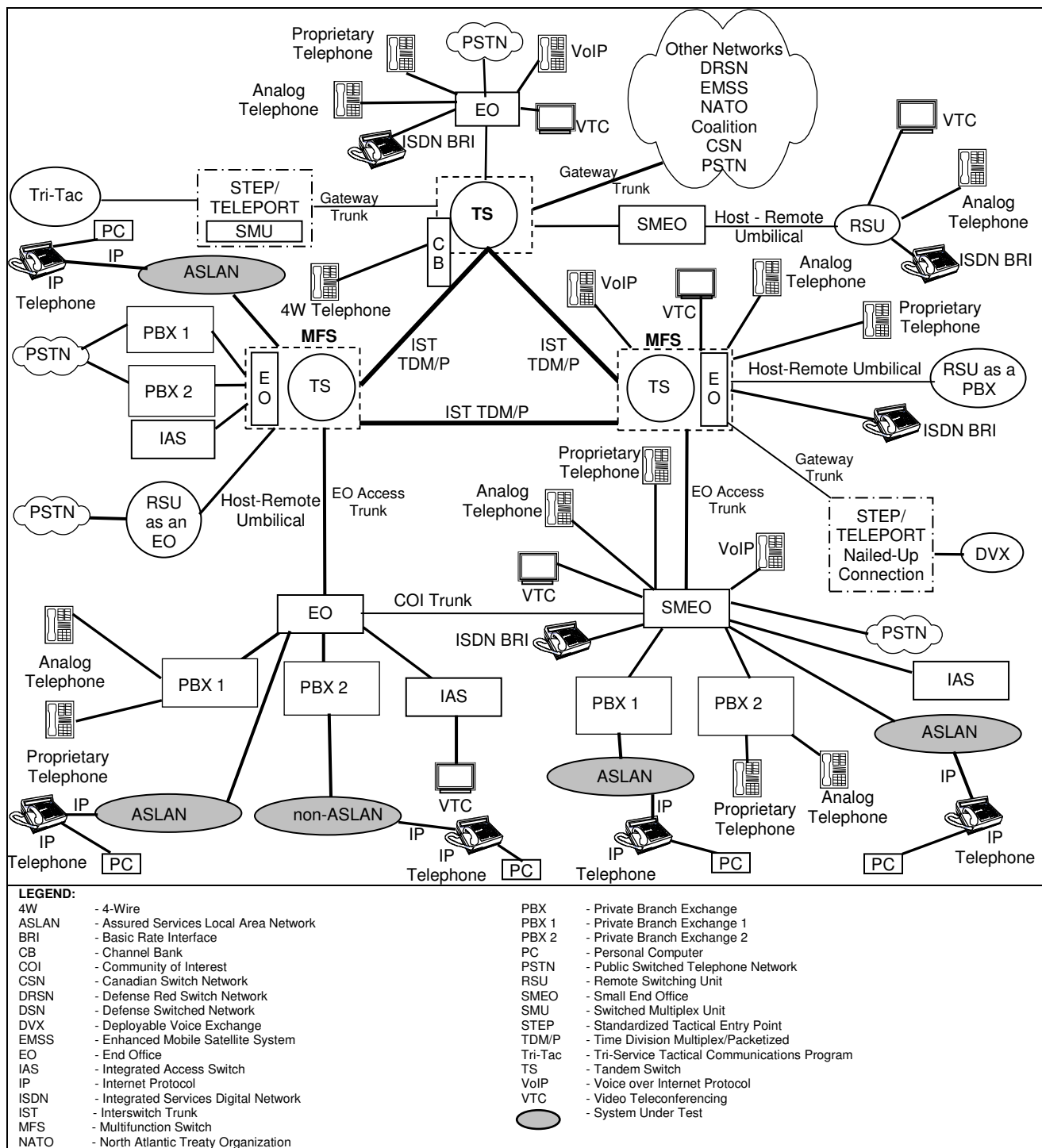


Figure 2-1. DSN Architecture

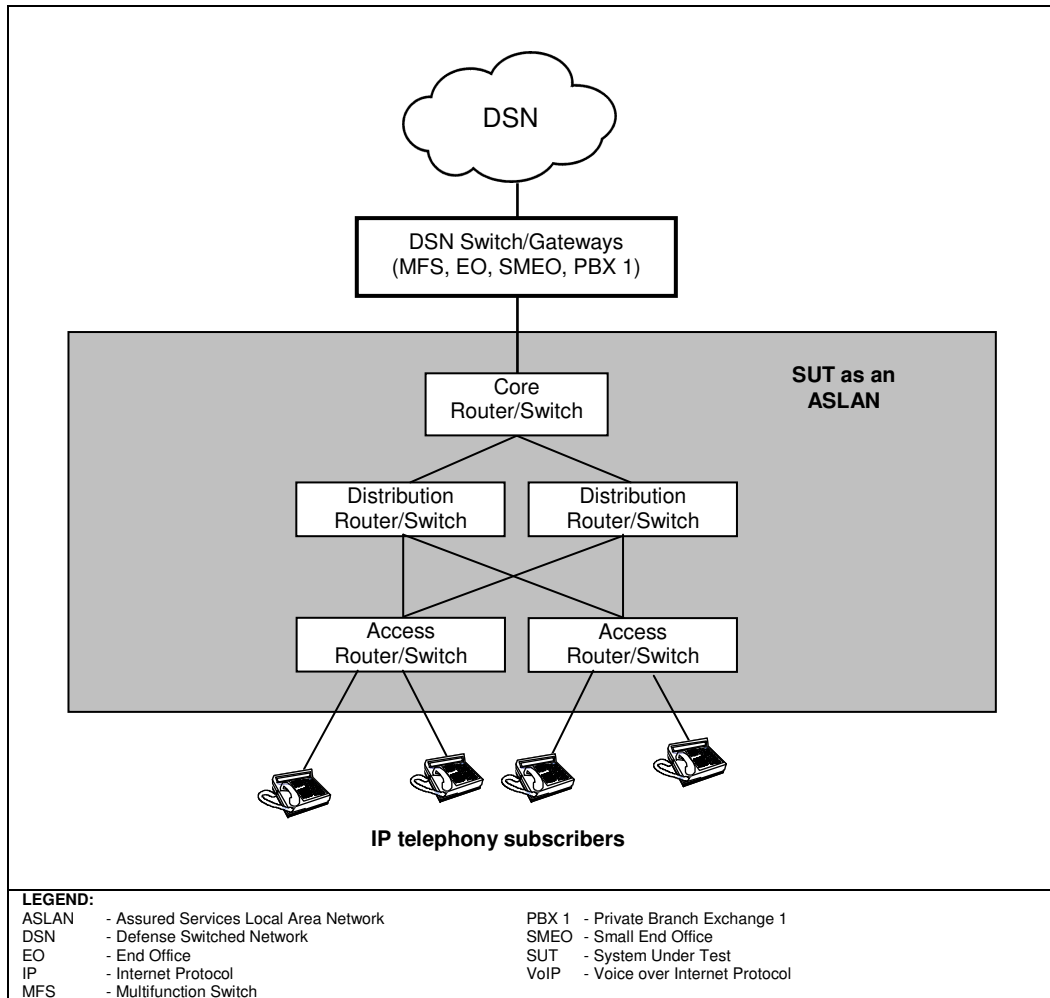


Figure 2-2. ASLAN VoIP Architecture

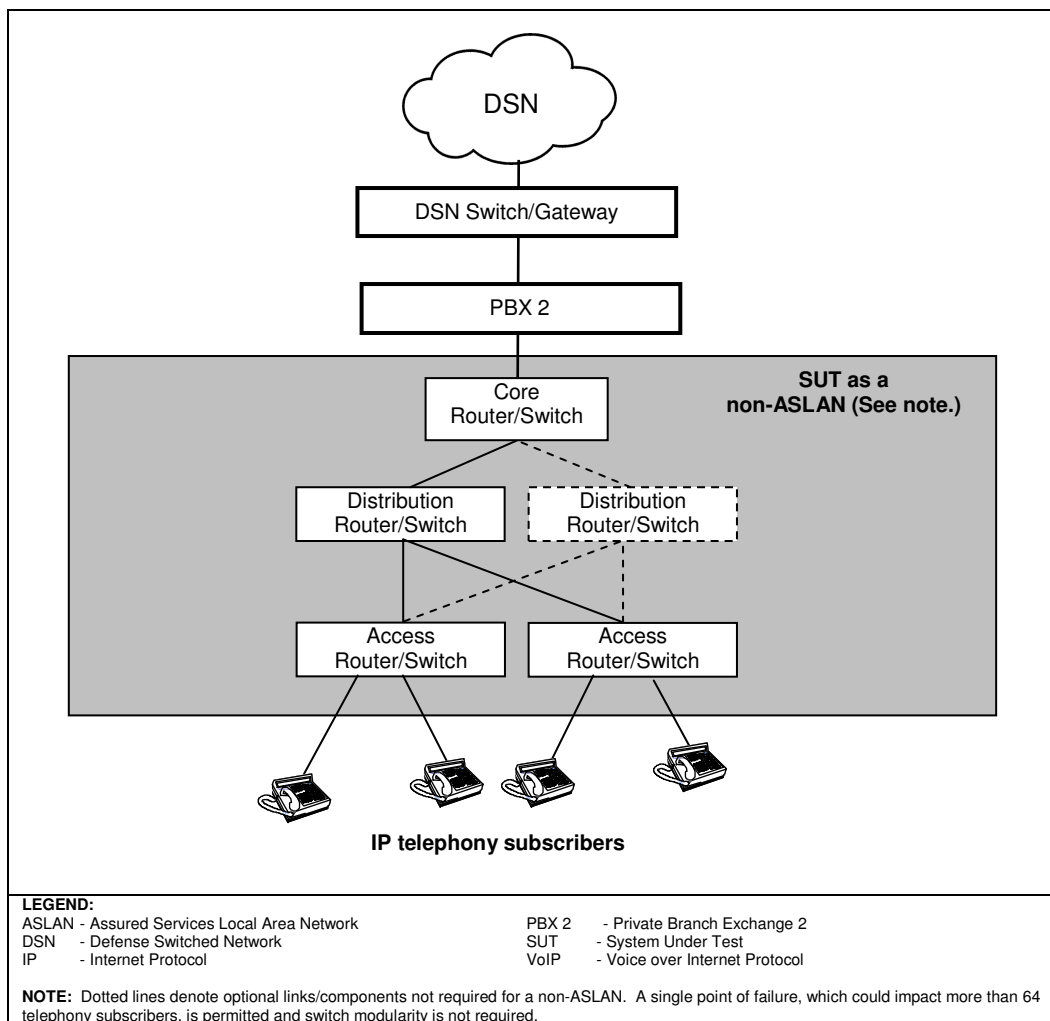


Figure 2-3. non-ASLAN VoIP Architecture

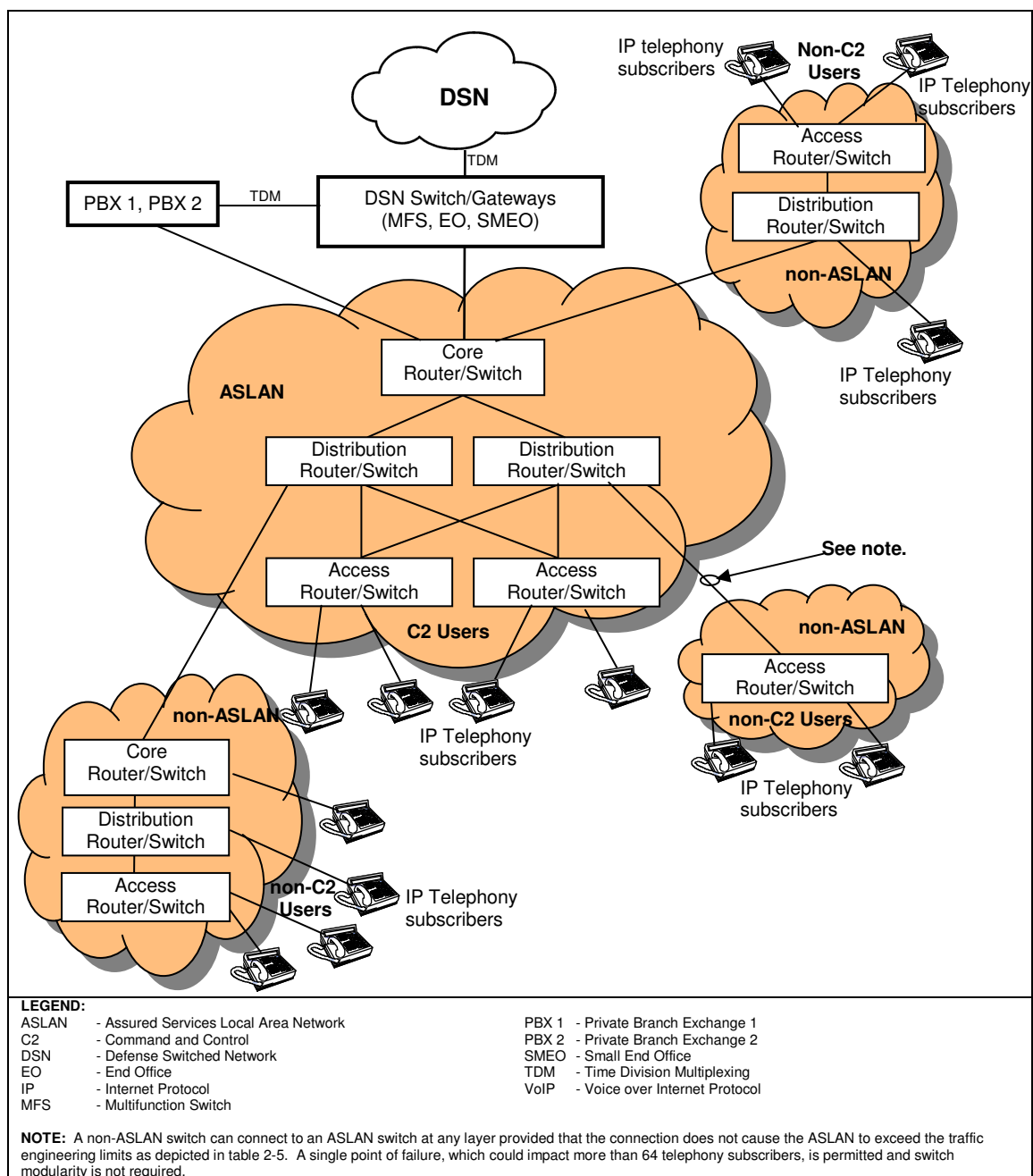


Figure 2-4. ASLAN and non-ASLAN Combined VoIP Architecture

7. REQUIRED SYSTEM INTERFACES. The SUT ASLAN and non-ASLAN system requirements are listed in table 2-1. The requirements specific to the SUT ASLAN and non-ASLAN components are shown in table 2-2. These requirements are derived from:

a. DSN services for Network and Applications specified in Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6215.01C, "Policy for Department of Defense Voice Services with Real Time Services (RTS)."

b. UCR, appendix 3, Capability Requirements (CRs) and Feature Requirements (FRs) verified through JITC testing and/or vendor submission of Letters of Compliance (LoC).

Table 2-1. ASLAN and non-ASLAN System Requirements

System Requirements				
Requirement	Criteria		UCR Paragraph	Required
Delay	One-way packet delay for voice packets of an established call (signaling and media) shall be 5 ms or less averaged over any 5-minute period.		A3.3.2.1	Yes
Jitter	For voice media packets, jitter shall be 5 ms or less averaged over any 5-minute period.		A3.3.2.2	Yes
Packet Loss	Voice packet loss within the LAN shall not exceed 0.05% averaged over any 5-minute period.		A3.3.2.3	Yes
Network Management	LAN Network Management Interface. One of the following methods: In-band, or Out-of-band		A3.3.7.1	Yes
	LAN Configuration Control		A3.3.7.2	Yes
	LAN Operational Changes		A3.3.7.3	Yes
	LAN Performance Monitoring		A3.3.7.4	Yes
	LAN Alarms		A3.3.7.5	Yes
	LAN Reporting		A3.3.7.6	Yes
Availability	ASLAN	99.999% Availability	A3.3.9.2	Yes
	non-ASLAN	99.9% Availability	A3.3.9.2	Yes
Redundancy	ASLAN	No Single Point of Failure that can cause an outage of more than 64 IP telephony subscribers	A3.3.9.3	Yes
	non-ASLAN	No Single Point of Failure that can cause an outage of more than 64 IP telephony subscribers	A3.3.9.3	No
Survivability	ASLAN	Service continuity in the presence of faults within the network	A3.3.9.4	Yes
	non-ASLAN	Service continuity in the presence of faults within the network	A3.3.9.4	No
Traffic Engineering	Voice bandwidth not to exceed 25 percent of available bandwidth, ITU-T G.711 codec with 20ms sample size.		A3.3.9.6	Yes
IPv6	All IP devices shall be IPv6 capable.		1.7 and A3.2.8	Yes
Security	DIACAP/IA (See note.)		A3.3.8	Yes
LEGEND:				
ASLAN	- Assured Services LAN		ITU-T	- International Telecommunication Union - Telecommunication
DIACAP	- Department of Defense Information Assurance Certification and Accreditation Process		Standardization Sector	
DISA	- Defense Information Systems Agency		LAN	- Local Area Network
G.711	- PCM of voice frequencies		ms	- milliseconds
IA	- Information Assurance		PCM	- Pulse Code Modulation
IP	- Internet Protocol		UCR	- Unified Capabilities Requirements
IPv6	- Internet Protocol version 6			
NOTE: Security testing is accomplished via DISA-led Information Assurance test teams and published in a separate report.				

Table 2-2. ASLAN and non-ASLAN Component Requirements

Core/Distribution/Access Component Requirements				
Requirement	Criteria		UCR Paragraph	Required
Traffic Prioritization	Traffic within LAN components shall be prioritized by session media type in accordance with the NCIDs.		A3.3.3	Yes
Traffic Priority Method	LAN components shall support DSCP, and IEEE 802.1p to DSCP mapping.		A3.3.3.1	Yes
Queuing	LAN components shall support one of the following: - Priority Queuing - Weighted Fair Queuing - Class Based Weighted Fair Queuing		A3.3.4.1	Yes
	LAN components shall be capable of - four hardware queues (Expedited Forwarding, Assured Forwarding, Assured Forwarding Preferred, and Default) - Assigning any “tagged” session to any hardware queues		A3.3.4.1	Yes
LAN Behaviors	LAN components shall support Differential Service Per-Hop Behaviors per RFCs 2474, 2475, and 3260		A3.3.4.2	Yes
VLANs	LAN components shall support: - Port based VLANs - MAC address based VLANs - Shall be capable of reassigning VLAN IDs - Accepting VLAN tagged frames in accordance with IEEE 802.1Q		A3.3.5	Yes
IEEE Conformance	LAN components shall support: - IEEE 802.1d – Bridging - IEEE 802.1p/Q – Priority tagging/VLAN tagging - IEEE 802.1s – Per-VLAN Group Spanning Tree - IEEE 802.1v – VLAN Classification by port and protocol - IEEE 802.1w –Rapid Reconfiguration of Spanning Tree - IEEE 802.1x – Port Based Network Access Control - IEEE 802.3ad – Link Aggregation Protocol - IEEE 802.3af - Power over Ethernet (Conditional)		A3.3.9.1	Yes
Single Device Redundancy	ASLAN	LAN components shall support: - ASLAN components shall have a reliability of .99999 or better - Dual power supplies and dual processors (more than 64 users) - N+1 sparing for access (more than 64 users) - Redundancy protocol ¹ - 2 second path restoral - No single point of failure will cause loss of more than 64 users	A3.3.9.3.1	Yes
	non-ASLAN	This requirement is conditional for a non-ASLAN.	A3.3.9.3.1	No
Security	LAN components shall employ the Network Infrastructure and VoIP STIGs. ²		A3.3.8	Yes
IPv6	All IP devices shall be IPv6 capable.		1.7 and A3.2.8	Yes
LEGEND: 802.1d - Standard for Local and Metropolitan Area Networks: MAC Bridges 802.1p - LAN Layer 2 QoS/CoS Protocol for Traffic Prioritization 802.1Q - Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks 802.1s - Standard for Local and Metropolitan Area Networks - Amendment 3 to 802.1Q Virtual Bridged Local Area Networks: Multiple Spanning Trees 802.1v - Standard for Local and Metropolitan Area Networks - Virtual Bridge Local Area Networks - Amendment 2: VLAN Classification by Protocol and Port (Amendment to IEEE 802.1Q, 1998 Edition) 802.1w - Standard for Local and metropolitan area networks - Common Specifications - Part 3: Media Access Control (MAC) Bridges: Rapid Configuration 802.1x - Standard for Local and Metropolitan Area Networks Port-Based Network Access Control 802.3ad - Standard for Information Technology – Local and Metropolitan Area Networks – Part 3: CSMA/CD Access Method and Physical Layer Specifications–Aggregation of Multiple Link Segments 802.3af - Standard for CSMA/CD Access Method and Physical Layer Specifications - Data Terminal Equipment (DTE) Power via Media Dependent Interface (MDI) ASLAN - Assured Services LAN CoS - Class of Service CSMA/CD - Carrier Sense Multiple Access with Collision Detection DISA - Defense Information Systems Agency DSCP - Differentiated Services Code Point IEEE - Institute of Electrical and Electronics Engineers ID - Identification IP - Internet Protocol IPv6 - Internet Protocol version 6 LAN - Local Area Network MAC - Media Access Control NCID - Net-Centric Implementation Document N - total VoIP users / 64 OSPF - Open Shortest-Path First QoS - Quality of Service RFC - Request for Comment STIGs - Security Technical Implementation Guides UCR - Unified Capabilities Requirements VLANs - Virtual LANs VoIP - Voice over Internet Protocol VRRP - Virtual Router Redundancy Protocol				
NOTES: 1 For core and distribution components, OSPF redundancy protocol shall be the routing protocol supported. For access components, redundancy protocol shall be VRRP or equivalent protocol. 2 Security is tested by DISA-led Information Assurance test teams and published in a separate report.				

8. TEST NETWORK DESCRIPTION. The SUT was tested at JITC's Global Information Grid Network Test Facility in a manner and configuration similar to that of the DSN operational environment. Figure 2-5 depicts the SUT test configuration.

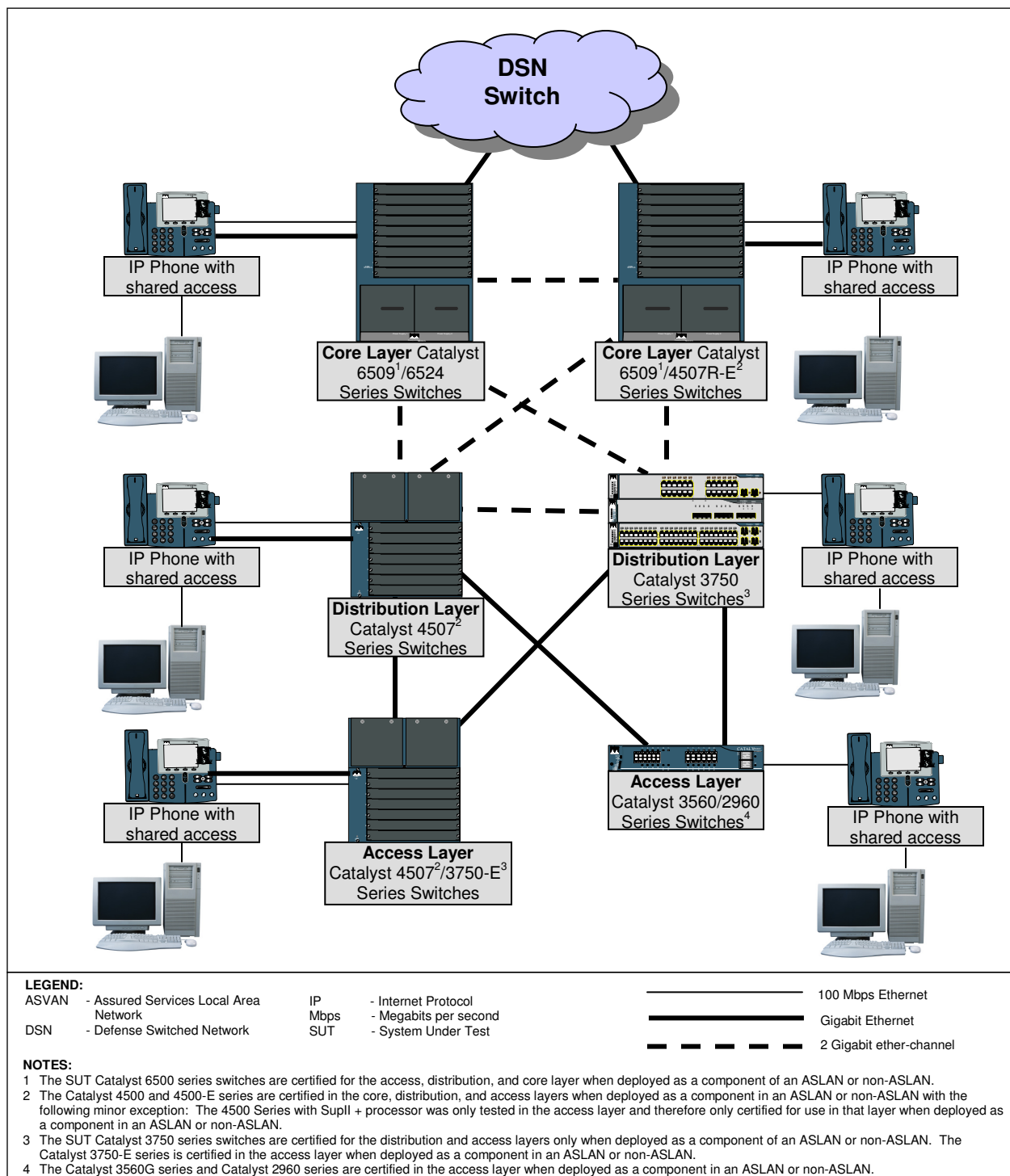


Figure 2-5. SUT Test Configuration

9. SYSTEM CONFIGURATIONS. Table 2-3 provides the system configurations, hardware and software components tested with the SUT. The SUT was tested in an

operationally realistic environment to determine interoperability with the DSN switch noted in table 2-3. The DSN switch listed in table 2-3 only depicts the tested configuration. Table 2-3 is not intended to identify the only switches that are certified with the SUT. The SUT is certified with switching systems listed on the DSN Approved Products List (APL) that are certified for use with an ASLAN or non-ASLAN.

Table 2-3. Tested System Configurations

System Name		Software Release	
Cisco CallManager		Version 4.2(3) Service Release 3 with IOS Software Release 12.4(9) T1	
System Under Test Components with Current Operating System			
Component (See note 1.)	Release	Sub-component (See note 1.)	Function
WS-C6503-E, WS-C6504-E, WS-C6506-E, <u>WS-C6509-E</u> , WS-C6509-NEB-A, WS-C6513, WS-C6503, WS-C6504, WS-C6506, <u>WS-C6509</u> , WS-C6509-NEB,	IOS 12.2 (33) SXH	WS-SUP720-3B	Catalyst 6500/Cisco 7600 Supervisor 720 Fabric MSFC3 PFC3B
		WS-SUP720	Catalyst 6500/Cisco 7600 Supervisor 720 Fabric MSFC3 PFC3A
		<u>WS-SUP720-3BXL</u>	Catalyst 6500/Cisco 7600 Supervisor 720 Fabric MSFC3 PFC3BXL
		<u>WS-SUP32-GE-3B</u>	Catalyst 6500 Supervisor 32 with 8 GE uplinks and PFC3B
		WS-SUP32-10GE-3B	Catalyst 6500 Supervisor 32 with 2 ports 10GbE and PFC3B
		<u>WS-X6148-RJ45V</u>	Catalyst 6500 48-port 10/100 Inline Power, RJ-45
		WS-X6148-RJ-45	Catalyst 6500 48-Port 10/100, Upgradeable to Voice, RJ-45
		WS-X6148-RJ-21	Catalyst 6500 48-Port 10/100 Upgradeable to Voice, RJ-21
		WS-X6148-R21V	Catalyst 6500 48-port 10/100 Inline Power Module, RJ-21
		<u>WS-X6148-45AF</u>	Catalyst 6500 PoE 802.3af 10/100, 48 port(RJ45) line card
		WS-X6148-21AF	Catalyst 6500 PoE 802.3af 10/100, 48 port (RJ21) line card
		<u>WS-X6708-10G-3CXL</u>	Catalyst 6500 8 port 10 Gigabit Ethernet module with DFC3CXL (req. X2)
		<u>WS-X6148X2-45AF</u>	Catalyst 6500 PoE 802.3af 10/100, 96-Port (RJ-45) line card
		<u>WS-X6148-FE-SFP</u>	Catalyst 6500 48-port 100FX SFP Ethernet Module
		<u>WS-X6704-10GE</u>	Catalyst 6500 CEF720 4 port 10-Gigabit Ethernet
		<u>WS-X6816-GBIC</u>	Catalyst 6500 16-port GigE mod, 2 fab I/F, (Req. GBICs, DFC/DFC3)
		<u>WS-X6708-10GE</u>	Catalyst 6500 CEF720 8 port 10GE with DFC
		<u>WS-X6148V-GE-TX</u>	Catalyst 6500 48-port 10/100/1000 Inline Power Module, RJ-45
		WS-X6148-GE-TX	Catalyst 6500 48-port 10/100/1000 GE Mod., RJ-45
		<u>WS-X6148-GE-45AF</u>	Catalyst 6500 PoE 802.3af 10/100/1000, 48 port(RJ45)line card
		<u>WS-X6148A-GE-45AF</u>	Catalyst 6500 48-Port PoE 802.3af 10/100/1000, w/Jumbo Frame
		WS-X6148A-GE-TX	Catalyst 6500 48-port 10/100/1000 w/Jumbo Frame, RJ-45
		WS-X6148A-RJ-45	Catalyst 6500 48-Port 10/100 w/TDR, Upgradable - PoE 802.3af
		WS-X6148A-45AF	Catalyst 6500 48-Port PoE 802.3af 10/100,card w/TDR
		<u>WS-X6348-RJ45V</u>	Catalyst 6500 48-port 10/100 Inline Power, RJ-45
		WS-X6348-RJ45	Catalyst 6500 48-port 10/100, RJ-45
		WS-X6348-RJ21V	Catalyst 6500 48-port 10/100 Inline Power, RJ-21
		WS-X6516-GE-TX	Catalyst 6500 16-port 10/100/1000 GE Module, Cross-Bar
		<u>WS-X6516-GBIC</u>	Catalyst 6500 16 port GigE line card - Optical interface
		<u>WS-X6516A-GBIC</u>	Catalyst 6500 16-port GigE Mod, fabric-enabled (Req. GBICs)
		<u>WS-X6548V-GE-TX</u>	Catalyst 6500 48-port fab-enabled 10/100/1000 inline pwr mod
		<u>WS-X6548-GE-TX</u>	Catalyst 6500 48-port fabric-enabled 10/100/1000 Module
		WS-X6548-RJ-21	Catalyst 6500 48-port 10/100, RJ-21, fabric-enabled
		WS-X6548-RJ-45	Catalyst 6500 48-port 10/100, RJ-45, x-bar
		WS-X6548-GE-45AF	Catalyst 6500 PoE 802.3af 10/100/1000 48-port(RJ45)CEF256 card
		<u>WS-X6816-GBIC</u>	Catalyst 6500 16-port GigE mod, 2 fab I/F, (Req GBICs, DFC/DFC3)
		<u>WS-X6748-SFP</u>	Catalyst 6500 48-port GigE Mod: fabric-enabled (Req. SFPs)
		WS-X6724-SFP	Catalyst 6500 24-port GigE Mod: fabric-enabled (Req. SFPs)
		WS-X6748-GE-TX	Catalyst 6500 48-port 10/100/1000 GE Mod: fabric enabled, RJ-45

Table 2-3. Tested System Configurations (continued)

Component (See note 1.)	Release	Sub-component (See note 1.)	Function
WS-C6503-E, WS-C6504-E, WS-C6506-E, <u>WS-C6509-E</u> , WS-C6509-NEB-A, WS-C6513, WS-C6503, WS-C6504, WS-C6506, <u>WS-C6509</u> , WS-C6509-NEB	IOS 12.2 (33) SXH	WS-X6708-10G-3C	Catalyst 6500 8 port 10 Gigabit Ethernet module with DFC3C (req. X2)
		WS-X6148X2-RJ-45	Cat6500 96-Port 10/100 (RJ45), Upgradable to PoE 802.3af
		WS-X6196-RJ-21	Catalyst 6500 96-Port 10/100 Upgradable - PoE 802.3af
		WS-X6196-21AF	Cat6500 96-Port, PoE 802.3af 10/100 - RJ-21
<u>ME-C6524GS-8S</u>	IOS 12.2 (33) SXH	Not Applicable	
ME-C6524GT-8S		Not Applicable	
WS-C4510R, <u>WS-C4507R</u> , WS-C4506 ² , WS-C4503 ² , WS-C4503-E ² , WS-C4506-E ² , <u>WS-C4507R-E</u> , WS-C4510R-E	IOS 12.2 (40) SG	<u>WS-X4516-10GE (Sup V)</u>	Catalyst 4500 Supervisor V-10GE, 2x10GE (X2) and 4x1GE (SFP)
		WS-X4516 (Sup V)	Catalyst 4500 Supervisor V (2 GE), Console(RJ-45)
		<u>WS-X4013+10GE</u>	Catalyst 4500 Sup II+10GE, 2x10GE (X2) and 4x1GE (SFP)
		WS-X4013+	Catalyst 4500 Supervisor II-Plus (IOS), 2GE, Console(RJ-45)
		<u>WS-X4306-GB</u>	Catalyst 4500 Gigabit Ethernet Module, 6-Ports (GBIC)
		WS-X4302-GB	Catalyst 4500 Gigabit Ethernet Module, 2-Ports (GBIC)
		WS-X4506-GB-T	Catalyst 4500 6-Port 10/100/1000 PoE or SFP (Optional)
		<u>WS-X4148-RJ45V</u>	Catalyst 4500 pre-standard PoE 10/100, 48-Ports (RJ45)
		WS-X4124-RJ45	Catalyst 4500 10/100 Module, 24-Ports(RJ45)
		WS-X4148-RJ45	Catalyst 4500 10/100 Auto Module, 48-Ports (RJ-45)
		WS-X4148-RJ21	Catalyst 4500 10/100 Module, 48-Ports Telco (4xRJ21)
		<u>WS-X4148-FX-MT</u>	Catalyst 4500 100BaseFX (FX-MT)
		WS-X4124-FX-MT	Catalyst 4500 FE Switching Module, 24- 100FX (MTRJ)
		WS-X4248-FE-SFP	Catalyst 4500 48-Port 100BASE-X (SFPs Optional)
		WS-X4148-FE-BD-LC	Catalyst 4500 FE Module, 48-Port BX-D (LC) (1550)
		WS-X4148-FE-LX-MT	Catalyst 4500 FE module, 48-port 100LX SMF (MTRJ)
		<u>WS-X4232-GB-RJ</u>	Catalyst 4500 32-10/100 (RJ-45), 2-GE(GBIC)
		WS-X4232-RJ-XX	Catalyst 4500 10/100 Module, 32-ports(RJ45)+Modular uplinks
		<u>WS-X4248-RJ45V</u>	Catalyst 4500 PoE 802.3af 10/100, 48-Ports (RJ45)
		WS-X4248-RJ21V	Catalyst 4500 PoE 802.3af 10/100, 48-Ports (RJ21)
		WS-X4224-RJ45V	Catalyst 4500 10/100 PoE 802.3af 24-ports (RJ45)
		<u>WS-X4548-GB-RJ45V</u>	Catalyst 4500 PoE 802.3af 10/100/1000, 48-Ports (RJ45)
		<u>WS-X4548-GB-RJ45</u>	Catalyst 4500 Enhanced 48-Port 10/100/1000 Base-T (RJ-45)
		WS-X4524-GB-RJ45V	Catalyst 4500 PoE 802.3af 10/ 100/1000 24-ports (RJ45)
		WS-X4448-GB-RJ45	Catalyst 4500 48-Port 10/100/1000 Module (RJ45)
		WS-X4424-GB-RJ45	Catalyst 4500 24-port 10/100/1000 Module (RJ45)
		<u>WS-X45-SUP6-E</u>	Catalyst 4500 E-Series Sup 6-E, 2x10GE(X2) w/ Twin Gig
		WS-X45-SUP6-E/2	Catalyst 45xxR E-Series Sup 6-E, 2x10GE(X2) w/ Twin Gig
		WS-X4648-RJ45V-E	Catalyst 4500 E-Series 48-Port PoE 802.3af 10/100/1000(RJ45)
		<u>WS-X4606-X2-E</u>	Catalyst 4500 E-Series 6-Port 10GbE (X2)
		<u>WS-X4648-RJ45V+E</u>	Catalyst 4500 E-Series 48-Port Premium PoE 10/100/1000
		WS-X4648-RJ45V-E	Catalyst 4500 E-Series 48-Port PoE 802.3af 10/100/1000(RJ45)

Table 2-3. Tested System Configurations (continued)

Component (See note 1.)	Release	Sub- component (See note 1.)	Function
WS-C3750G-24T-S	IOS 12.2 (40) SE	Not Applicable	Catalyst 3750 24 10/100/1000T Standard Multilayer Image
WS-C3750G-24T-E			Catalyst 3750 24 10/100/1000T Enhanced Multilayer Image
WS-C3750G-24TS-S			Catalyst 3750 24 10/100/1000 + 4 SFP Std Multilayer; 1.5RU
WS-C3750G-24TS-E			Catalyst 3750 24 10/100/1000 + 4 SFP Enhanced Multilayer;1.5RU
WS-C3750G-24TS-S1U			Catalyst 3750 24 10/100/1000 + 4 SFP Std Multilayer;1RU
WS-C3750G-24TS-E1U			Catalyst 3750 24 10/100/1000 + 4 SFP Enh Multilayer;1RU
<u>WS-C3750G-24PS-S</u>			Catalyst 3750 24 10/100/1000T PoE + 4 SFP Standard Image
WS-C3750G-24PS-E			Catalyst 3750 24 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3750G-48TS-E			Catalyst 3750 48 10/100/1000T + 4 SFP Enhanced Multilayer
WS-C3750G-48PS-S			Catalyst 3750 48 10/100/1000T PoE + 4 SFP Standard Image
WS-C3750G-48PS-E			Catalyst 3750 48 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3750G-12S-S			Catalyst 3750 12 SFP Standard Multilayer Image
WS-C3750G-12S-SD			Catalyst 3750 12 SFP DC powered Standard Multilayer Image
<u>WS-C3750G-12S-E</u>			Catalyst 3750 12 SFP Enhanced Multilayer Image
WS-C3750E-24TD-E			Catalyst 3750E 24 10/100/1000+2*10GE(X2),265W,IPS s/w
<u>WS-C3750-24FS-S</u>			Catalyst 3750 24 100BaseFX + 2 SFP Standard Multilayer Image
WS-C3750-24PS-S			Catalyst 3750 24 10/100 PoE + 2 SFP Standard Image
WS-C3750-24PS-E			Catalyst 3750 24 10/100 PoE + 2 SFP Enhanced Image
WS-C3750-24TS-S			Catalyst 3750 24 10/100 + 2 SFP Standard Multilayer Image
WS-C3750-24TS-E			Catalyst 3750 24 10/100 + 2 SFP Enhanced Multilayer Image
WS-C3750-48PS-S			Catalyst 3750 48 10/100 PoE + 4 SFP Standard Image
<u>WS-C3750-48PS-E</u>			Catalyst 3750 48 10/100 PoE + 4 SFP Enhanced Image
WS-C3750-48TS-S			Catalyst 3750 48 10/100 + 4 SFP Standard Multilayer Image
WS-C3750-48TS-E			Catalyst 3750 48 10/100 PoE + 4 SFP Enhanced Image
WS-C3750E-24TD-S	IOS 12.2 (40) SE	Not Applicable	Catalyst 3750E 24 10/100/1000+2*10GE(X2),265W,IPB s/w
WS-C3750E-24TD-E			Catalyst 3750E 24 10/100/1000+2*10GE(X2),265W,IPS s/w
WS-C3750E-48TD-S			Catalyst 3750E 48 10/100/1000+2*10GE(X2),265W,IPB s/w
WS-C3750E-48TD-E			Catalyst 3750E 48 10/100/1000+2*10GE(X2),265W,IPS s/w
WS-C3750E-24PD-S			Catalyst 3750E 24 10/100/1000 PoE+2*10GE(X2),750W,IPB s/w
<u>WS-C3750E-24PD-E</u>			Catalyst 3750E 24 10/100/1000 PoE+2*10GE(X2),750W,IPS s/w
WS-C3750E-48PD-S			Catalyst 3750E 48 10/100/1000 PoE+2*10GE(X2),750W,IPB s/w
<u>WS-C3750E-48PD-E</u>			Catalyst 3750E 48 10/100/1000 PoE+2*10GE(X2),750W,IPS s/w
WS-C3750E-48PD-SF			Catalyst 3750E 48 10/100/1000 PoE+2*10GE(X2),1150W,IPB s/w
WS-C3750E-48PD-EF			Catalyst 3750E 48 10/100/1000 PoE+2*10GE(X2),1150W,IPS s/w
WS-C3560G-48PS-S	IOS 12.2 (40) SE	Not Applicable	Catalyst 3560 48 10/100/1000T PoE + 4 SFP Standard Image
<u>WS-C3560G-48PS-E</u>			Catalyst 3560 48 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3560G-24PS-S			Catalyst 3560 24 10/100/1000T PoE + 4 SFP Standard Image
WS-C3560G-24PS-E			Catalyst 3560 24 10/100/1000T PoE + 4 SFP Enhanced Image
WS-C3560G-48TS-S			Catalyst 3560 48 10/100/1000T + 4 SFP Standard Image
WS-C3560G-48TS-E			Catalyst 3560 48 10/100/1000T + 4 SFP Enhanced Image
WS-C3560G-24TS-S			Catalyst 3560 24 10/100/1000T + 4 SFP Standard Image
WS-C3560G-24TS-E			Catalyst 3560 24 10/100/1000T + 4 SFP Enhanced Image
<u>WS-C3560-8PC-S</u>			Catalyst 3560 8 10/100 PoE + 1 T/SFP Standard Image
WS-C3560-48PS-S			Catalyst 3560 48 10/100 PoE + 4 SFP Standard Image
WS-C3560-48PS-E			Catalyst 3560 48 10/100 PoE + 4 SFP Enhanced Image
WS-C3560-24PS-S			Catalyst 3560 24 10/100 PoE + 2 SFP Standard Image
WS-C3560-24PS-E			Catalyst 3560 24 10/100 PoE + 2 SFP Enhanced Image
WS-C3560-48TS-S			Catalyst 3560 48 10/100 + 4 SFP Standard Image

Table 2-3. Tested System Configurations (continued)

Component (See note 1.)	Release	Sub- component (See note 1.)	Function		
WS-C3560-48TS-E	IOS 12.2 (40) SE	Not Applicable	Catalyst 3560 48 10/100 + 4 SFP Enhanced Image		
WS-C3560-24TS-S			Catalyst 3560 24 10/100 + 2 SFP Standard Image		
WS-C3560-24TS-E			Catalyst 3560 24 10/100 + 2 SFP Enhanced Image		
WS-C3560E-24TD-S			Catalyst 3560E 24 10/100/1000+2*10GE(X2),265W,IPB s/w		
WS-C3560E-24TD-E			Catalyst 3560E 24 10/100/1000+2*10GE(X2),265W,IPS s/w		
WS-C3560E-48TD-S			Catalyst 3560E 48 10/100/1000+2*10GE(X2),265W,IPB s/w		
WS-C3560E-48TD-E			Catalyst 3560E 48 10/100/1000+2*10GE(X2),265W,IPS s/w		
WS-C3560E-24PD-S			Catalyst 3560E 24 10/100/1000 PoE+2*10GE(X2),750W,IPB s/w		
WS-C3560E-24PD-E			Catalyst 3560E 24 10/100/1000 PoE+2*10GE(X2),750W,IPS s/w		
WS-C3560E-48PD-S			Catalyst 3560E 48 10/100/1000 PoE+2*10GE(X2),750W,IPB s/w		
<u>WS-C3560E-48PD-E</u>			Catalyst 3560E 48 10/100/1000 PoE+2*10GE(X2),750W,IPS s/w		
WS-C3560E-48PD-SF			Catalyst 3560E 48 10/100/1000 PoE+2*10GE(X2),1150W,IPB s/w		
WS-C3560E-48PD-EF			Catalyst 3560E 48 10/100/1000 PoE+2*10GE(X2),1150W,IPS s/w		
WS-C2960-8TC-L			IOS 12.2 (40) SE	Not Applicable	Catalyst 2960 8 10/100 + 1 T/SFP LAN Base Image
WS-C2960-24TC-L					Catalyst 2960 24 10/100 + 2T/SFP LAN Base Image
WS-C2960-24TT-L					Catalyst 2960 24 10/100 + 2 1000BT LAN Base Image
WS-C2960-48TC-L	Catalyst 2960 48 10/100 + 2 T/SFP LAN Base Image				
WS-C2960-48TT-L	Catalyst 2960 48 10/100 + 2 1000BT LAN Base Image				
<u>WS-C2960G-8TC-L</u>	Catalyst 2960 7 10/100/1000 + 1 T/SFP LAN Base				
WS-C2960G-24TC-L	Catalyst 2960 24 10/100/1000, 4 T/SFP LAN Base Image				
WS-C2960G-48TC-L	Catalyst 2960 48 10/100/1000, 4 T/SFP LAN Base Image				
WS-C2960-24-S	Catalyst 2960 24 10/100 LAN Lite Image				
WS-C2960-24TC-S	Catalyst 2960 24 10/100 + 2 T/SFP LAN Lite Image				
WS-C2960-48TC-S	Catalyst 2960 48 10/100 + 2 T/SFP LAN Lite Image				
WS-C2960PD-8TT-L	Catalyst 2960 Powered Device 8 10/100 + 1 1000BT LAN Base				
LEGEND: E - Enhanced GBIC - Gigabit Interface Converter GE - Gigabit Ethernet IOS - Internetwork Operating System JITC - Joint Interoperability Test Command LAN - Local Area Network NEB - Network Equipment Building POE - Power over Ethernet Req. - requires RJ - Registered Jack S - Standard SFP - Small Form Factor Pluggable T1 - Trunk level 1 TDR - Time Domain Reflectometer TX - The designation of a cooper RJ-45 connection for Fast Ethernet SE - Systems Engineering SW - Station Wire WS - Workgroup Switch					
NOTES: 1 Components and sub-components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same operating software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use. 2 Indicates these switches support one processor and must be configured to failover to a redundant distribution switch.					

10. TESTING LIMITATIONS. None.

11. TEST RESULTS

a. Components. The SUT met the minimum interoperability requirements of the UCR, appendix 3, for an ASLAN. If a system meets the minimum requirements for an ASLAN, it also meets the lesser requirements for a non-ASLAN. The network consisted of three main components: core, distribution, and access switches. The SUT system and component test results are provided below.

(1) Class of Service (CoS). The UCR, appendix 3, section A3.3.3, outlines several methodologies to implement CoS. The SUT employed IEEE 802.1p/Q at the Data Link Layer (L2) and Differentiated Services Code Point (DSCP) at the Network Layer (L3) and 802.1p/Q to DSCP mapping, which was verified by capturing packets at both layers within the network.

(2) Traffic Prioritization. Priorities were applied in accordance with the CoS listed above. As required by the UCR, this ensured voice signaling would get the highest level of priority; voice media stream would be prioritized lower than voice signaling but higher than data, and data traffic would receive the lowest priority. At L2, packets were tagged as: Data traffic = 0, Voice media = 5 and Voice Signaling and Network Management = 6, for L3 prioritization, DSCP were marked 0, 46, and 48 respectively. Uplinks were filled to capacity with data packets and voice packets were transmitted across the SUT. The voice packets were placed in a higher queue and were not delayed throughout the network. The SUT configuration for all access layer ports was trusted. This was accomplished by default or by assigning the trust QoS statements to all ports.

(3) QoS. The SUT QoS process is supported by 8 queues using Priority Queuing. Packets tagged with a CoS of 6 are queued in a highest priority queue. The CoS values of 5 and 0 are placed in separate queues, with 5 receiving a higher value therefore, it will be serviced more frequently than 0. These tags were used to identify and separate traffic types that pass through the network connections ensuring that signaling traffic and voice traffic take precedence over data traffic.

During failover testing of the Cisco Catalyst 3750 switch, an anomaly was noted during the processor failover testing. After a failover occurs, if a new Cisco IP phone is added and the interface is configured with "auto qos voip cisco-phones," the 3750 fails to correctly tag voice signaling and media packets at L2 and L3. Therefore, all SUT switches must configure IP phone interfaces with the "auto qos voip trust" configuration command. Furthermore, the Cisco proprietary "auto qos cisco-phones" command is not authorized nor approved for use within the DSN by the Program Management Office.

(a) Queuing. The UCR, appendix 3, paragraph 3.3.4.1, outlines that an ASLAN must support at least one of the following queuing mechanisms: Priority Queuing, Custom Queuing, Weighted Fair Queuing, or Class-Based Weighted Fair Queuing. The SUT supports all of the queuing mechanisms; however, only Priority Queuing was tested and is covered under this certification. Priority Queuing supports queues from high to low. All packets of a higher priority queue will be transmitted before any packets from a lower priority queue. Queues are serviced in order of queue priority. The highest queue gets serviced first and then the next lower priority queue. If a lower priority queue is being serviced and a packet in the higher queue enters the higher queue, the higher priority queue gets serviced immediately after the current packet from the lower queue is sent. Then, once the higher priority queue is empty, the lower priority queue continues being serviced.

(4) Policing. The SUT implemented DiffServ Class-Based Shaping (CBS) that uses DSCP values to define how traffic is treated at each individual network node. DSCP values are used from the L3 IP header.

Traffic Policing limits the input or output transmission rate of a class of traffic based on user-defined criteria and marks packets by setting the IP Precedence value, the QoS group, or the DSCP value. The UCR, appendix 3, paragraph A3.3.4.2, outlines that the ASLAN must meet at least one of the following policing mechanisms: DiffServ PHB, Generic Traffic Shaping (GTS), or Class-Based Shaping (CBS). The SUT implemented DiffServ PHB which uses DSCP values to define how traffic is treated at each individual node. Traffic sharing a common DSCP header is known as a forwarding class. The forwarding behavior applied by a DiffServ-compliant node to each forwarding class is known as PHB. The DiffServ domain marks the DSCP values in packets so they can be routed to the same PHB on the next forwarding nodes until the packet reaches the final destination or leaves the DiffServ domain. Accurate metering, policing and shaping protect the DiffServ domain from excessive traffic loading. The DiffServ PHBs map directly to the following internal forwarding classes along the path of the packet:

- Expedited Forwarding (EF) classes have a premium forwarding status above all other classes. Other forwarding classes cannot affect the latency or jitter experienced by traffic in these premium classes. The EF PHB allows unlimited preemption of other traffic, the implementation limits damage EF traffic inflicts on other traffic. The DSCP values of 46 for voice media and 48 for voice signaling are placed in the EF class.
- Assured Forwarding class packets transmitted through the queue at or below the committed transmission rate are marked “in-profile.” If sufficient bandwidth is available along the path for assured traffic, packets will reach their destination. Packets transmitted out of the service queue that are above the committed rate and reach congestion in the network, are discarded before “in-profile” assured service packets.
- Best Effort Forwarding packets are lower priority packets and are forwarded after Expedited and Assured Forwarding packets have been forwarded.

(5) Virtual LAN (VLAN). The UCR, appendix 3, paragraph A3.3.5, outlines that the ASLAN shall support either implicit or explicit VLAN membership for: Port-based VLANs, Media Access Control (MAC) address-based VLANs, or L3 protocol-based VLANs. The SUT supports port-based VLANs. Switches within the topology were configured with multiple VLANs using the IEEE 802.1Q tag to separate data from voice traffic. MAC address and Protocol-based VLANs were verified through the LoC as well as packet captures.

(6) IEEE Conformance. All aspects of IEEE conformance were met through the LoC or testing. All test results are discussed under their respective topics.

(7) Reliability. The UCR, appendix 3, section A3.3.9.3, requires that there be no single point of failure within the ASLAN that can cause an outage of more than 64

telephony subscribers. The SUT utilized blades which support up to 96 copper IP interfaces. Examples are the WS-X6196-21AF and the WS-X6196-RJ-21. The end user shall not use more than 64 of these connections for IP telephony. The remaining 32 ports shall only be utilized for data connections. In order to meet the availability requirement of an ASLAN, all switching/routing platforms that offer more than 64 telephony subscribers shall have a switch design or configuration that provides at a minimum dual power supplies, dual processors, redundancy protocol, and switch fabric redundancy. To meet the reliability requirements, dual Gigabit and/or 10 Gigabit Link Aggregation was configured between the core and distribution switches, and dual Gigabit and/or 10 Gigabit L2 rapid spanning tree links connected the distribution and access switches, as shown in figure 2-5. The link aggregation from the distribution to the core must be terminated onto separate fiber cards at the core switch. Reliability is a conditional requirement for a non-ASLAN.

(8) Network Management. The UCR, appendix 3, paragraph A3.3.7, requires that the vendor provide a management system to monitor the performance of the ASLAN portion of the VoIP system. Due to numerous third party systems and applications capable of performing this function, this requirement was verified via LoC. Network Management features are conditional requirements for a non-ASLAN.

(9) Security. Security requirements in accordance with the UCR, appendix 3, paragraph A3.3.8, were verified using the Information Assurance Test Plan. Results of the security testing are reported in a separate test report generated by the Defense Information Systems Agency (DISA) Information Assurance test personnel.

(10) IPv6. The UCR, appendix 3, section A3.2.8, requires that VoIP systems must meet the IPv6 capability requirements as defined in the UCR, appendix 11. An IPv6 capable system or product, as defined in the UCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied with a vendor LoC signed by the Vice President of the company. The vendor stated, in writing, compliance to the following criteria:

(a) Conformant with IPv6 standards profile contained in the Department of Defense (DoD) Information Technology Standards Registry (DISR).

(b) Maintaining interoperability in heterogeneous environments and with IPv4.

(c) Commitment to upgrade as the IPv6 standard evolves.

(d) Availability of contractor/vendor IPv6 technical support.

Open Shortest Path First (OSPF) version two was used during the tests. OSPF version three (OSPF V.3) is required for IPv6 compatibility. IPv6 capabilities were not tested; however, they were met through the vendor's LoC.

(11) Traffic Engineering

(a) Links. To meet the ASLAN requirements for failover, all links connected between the core and distribution switches and between the distribution switches were configured as Link Aggregation. The link aggregation between the core and distribution must be terminated on separate fiber cards at each switch.

(b) Scalability. The SUT can be scaled to meet any number of IP phone subscribers as long as the SUT is composed of the equipment and software listed in table 2-3, and are consistent with traffic engineering constraints contained in the UCR, appendix 3. Table 2-4, which was approved by the DSN Configuration Control Board (DSN CCB) on Dec 2004, outlines the maximum number of subscribers that can be supported per each link capacity.

Table 2-4. IP Subscriber Supportability by Link Capacity

Link Type	LAN BW	Users
Non-Converged	10 Mbps	64 (See note 1.)
	100 Mbps	64 (See note 1.)
	1 Gbps	64 (See note 1.)
	10 Gbps	64 (See note 1.)
	10 Mbps LP	100 (See note 2.)
	100 Mbps LP	1000 (See note 2.)
	1 Gbps LP	10000 (See note 2.)
	10 Gbps LP	100000 (See note 2.)
Converged	10 Mbps	25 (See note 3.)
	100 Mbps	64 (See note 1.)
	1 Gbps	64 (See note 1.)
	10 Gbps	64 (See note 1.)
	10 Mbps LP	25 (See note 3.)
	100 Mbps LP	250 (See note 4.)
	1 Gbps LP	2500 (See note 4.)
	10 Gbps LP	25000 (See note 4.)
LEGEND: ASLAN - Assured Services LAN BW - Bandwidth Gbps - Gigabits per second IP - Internet Protocol kbps - kilobits per second LAN - Local Area Network LP - Link Pair Mbps - Megabits per second		
NOTES: 1 For single links, number of telephony subscribers is limited to a maximum of 64 because of single point of failure. This limit applies specifically to ASLANs. 2 The number of users is calculated as bandwidth (BW) divided by 100 kbps per user. 3 The number of users was limited to 64 telephony subscribers per note 1 or 25% of total users per note 1, whichever was less. 4 For the converged network, voice traffic was engineered not to exceed 25 % of total utilization using an estimated 100 kbps per voice call.		

(12) LAN Architectures. The Catalyst 6500 series is certified in the core, distribution, and access layers. The Catalyst 4500 and 4500-E series are certified in the core, distribution, and access layers with the following minor exception: The 4500 Series with SupII + processor was only tested in the access layer and therefore only certified for use in that layer. The Catalyst 3750 series is certified in the distribution and access layers. The Catalyst 3750-E series is certified in the access layer. The Catalyst

3560G series is certified in the access layer. The Catalyst 2960 series is certified in the access layer.

The core switches are connected in a fully redundant mode, using the port-channel architecture. These switches are also connected to the distribution switches in a full mesh.

The distribution layer switches are connected in a fully redundant mode to the core switches and to each other using the port-channel architecture. These switches also provide redundant connectivity to the access switches wherever possible. If there are less than 64 users, redundancy is not required.

The access layer switches provide access to telephony users. All SUT access layer switches can be configured and are certified for Power over Ethernet (PoE). Components which support the IEEE 802.3af standard are depicted with AF in the component title or function and they will provide PoE to any certified IP phone on the DSN APL which supports IEEE 802.3af. Other components which provide PoE but do not comply with the IEEE 802.3af standard will support any Cisco IP phone on the DSN APL. Other IP phones on the DSN APL will have to be powered by an external power supply if they are connected to a component that provides PoE but does not support the IEEE 802.3af standard.

Shared access (i.e., same switch port is shared by Personal Computer and IP phone), was tested and is certified with this configuration for shared access for speeds up to 1000 Mbps full duplex. To test 1000 Mbps shared access, the IP phones were connected to the 1000 Mbps full duplex access switch port and data was generated on the 1000 Mbps full duplex Ethernet port on the back of the phones using an IXIA test set. One other way to test this feature is to use the Ixia IxChariot software to generate concurrent voice and data loads, and evaluate the voice streams. All SUT switches that provide Ethernet access ports in this certification were tested for shared access with no measurable degradation of voice quality. Voice signaling, voice media and data packets were properly queued by the SUT.

To meet the ASLAN failover requirements, OSPF was implemented between the core and distribution layer. OSPF utilizes link-state protocols to identify lowest cost paths within the LAN. Additionally, OSPF is an open standard, and is a common protocol between different vendors equipment.

(a) Delay. The UCR, appendix 3, section A3.3.2.1, states the one-way packet delay shall be five milliseconds (ms) or less, as measured over a five-minute period. The average one-way delay for each of the sampled five-minute periods, measured between the access and core devices, was 0.0 ms, with a maximum delay of 1.0 ms, which met the requirement.

(b) Jitter. The UCR, appendix 3, section A3.3.2.2 states jitter for voice media packets will be 5 ms or less as averaged over any five-minute period. With a 100

percent bandwidth load, jitter was measured to be 0.0 ms or less over a five-minute period, which met the requirement.

(c) Packet Loss. Network packet loss occurs when packets are sent, but not received at the final destination. The UCR, appendix 3, section A3.3.2.3, states that LANs shall be engineered so the measured voice packet loss within the LAN shall not exceed 0.05 percent averaged over any five-minute period. With 100 percent bandwidth load, the measured packet loss was 0.00 percent, which met the requirement.

b. System Interoperability Results. The SUT is certified for joint use within the DSN with the digital switching systems listed on the DSN APL which are certified for use with an ASLAN or non-ASLAN. The SUT is certified to support DSN Assured Services over IP as an ASLAN in accordance with the requirements set forth in the UCR, appendix 3. The SUT is also certified as a non-ASLAN. However, since non-ASLANs do not support the Assured Services Requirements detailed in reference (c), Command and Control (C2) users and Special C2 users are not authorized to be served by a non-ASLAN. Since non-ASLANs do not support Assured Services, they can only serve DoD, non-DoD, non-governmental, and foreign government users having no missions or communications requirement to ever originate or receive C2 communications. Non-ASLAN connectivity to the DSN is not authorized until a waiver is granted by the Joint Staff for each site. The system interoperability test summary is shown in table 2-5 and the detailed component interoperability test status is shown table 2-6.

Table 2-5. SUT System Interoperability Test Summary

Device Requirement ¹	Reference	Test Results	Remarks
Delay measured at 5 ms or less	UCR, Appendix 3, A3.3.2.1	Met	The average was 0.0 ms and the maximum was 1.0 ms.
Jitter measured at less than 5 ms	UCR, Appendix 3, A3.3.2.2	Met	Measured to be 0.0 ms or less.
Packet Loss less than 0.05%	UCR, Appendix 3, A3.3.2.3	Met	Measured to be 0.00%.
Reliability	UCR, Appendix 3, Section A.3.3.9.3	Met	See note 2.
IPv6	UCR, Appendix 3, Section A3.2.8	Met	See note 3.
Security	UCR, Appendix 3, A3.3.8	Met	See note 4.
LEGEND: ASLAN - Assured Services Local Area Network DISA - Defense Information Systems Agency DISR - DoD Information Technology Standards Registry DoD - Department of Defense IPv4 - Internet Protocol version 4 IPv6 - Internet Protocol version 6 ms - millisecond SUT - System Under Test UCR - Unified Capabilities Requirements			
NOTES: 1 If a system meets the minimum requirements for an ASLAN, it also meets the lesser requirements for a non-ASLAN. 2 Reliability is a conditional requirement for a non-ASLAN. 3 An IPv6 capable system or product, as defined in the UCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria: a. Conformance with IPv6 standards profile contained in the DISR. b. Maintaining interoperability in heterogeneous environments and with IPv4. c. Commitment to upgrade as the IPv6 standard evolves. d. Availability of contractor/vendor IPv6 technical support. 4 Security is tested by DISA-led Information Assurance test teams and published in a separate report.			

Table 2-6. Component Interoperability Test Summary

DSN Line Interfaces						
Interface	Component (See note 1.)	Status	Device Requirement	Test Results	Reference	Remarks
1000Base SX/LX 100BaseFX 10/100/1000 BaseT	WS-C6503-E, WS-C6504-E, WS-C6506-E, <u>WS-C6509-E</u> , WS-C6509-NEB-A, WS-C6513, WS-C6503, WS-C6504, WS-C6506, <u>WS-C6509</u> , WS-C6509-NEB, <u>ME-C6524GS-8S</u> , ME-C6524GT-8S	Certified as: Core Distribution Access	CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²
1000Base SX/LX 10/100/1000 BaseT	WS-C4510R, <u>WS-C4507R</u> , WS-C4506 ² , WS-C4503 ² , WS-C4503-E ² , WS-C4506-E ² , <u>WS-C4507R-E</u> , WS-C4510R-E	Certified as: Core Distribution Access	CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²

Table 2-6. Component Interoperability Test Summary (continued)

DSN Line Interfaces						
Interface	Component (See note 1.)	Status	Device Requirement	Test Results	Reference	Remarks
1000Base SX/LX 10/100/1000 BaseT	WS-C3750G-24T-S, WS-C3750G-24T-E, WS-C3750G-24TS-S, WS-C3750G-24TS-E, WS-C3750G-24TS-S1U, WS-C3750G-24TS-E1U, <u>WS-C3750G-24PS-S</u> , WS-C3750G-24PS-E, WS-C3750G-48TS-E, WS-C3750G-48PS-S, WS-C3750G-48PS-E, WS-C3750G-12S-S, WS-C3750G-12S-SD, <u>WS-C3750G-12S-E</u> , WS-C3750E-24TD-E, <u>WS-C3750-24FS-S</u> , WS-C3750-24PS-S, WS-C3750-24PS-E, WS-C3750-24TS-S, WS-C3750-24TS-E, WS-C3750-48PS-S, <u>WS-C3750-48PS-E</u> , WS-C3750-48TS-S, WS-C3750-48TS-E	Certified as: Distribution Access	CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²
1000Base SX/LX 10/100/1000 BaseT	WS-C3750E-24TD-S, WS-C3750E-24TD-E, WS-C3750E-48TD-S, WS-C3750E-48TD-E, WS-C3750E-24PD-S, WS-C3750E-24PD-E, WS-C3750E-48PD-S, <u>WS-C3750E-48PD-E</u> , WS-C3750E-48PD-SF, WS-C3750E-48PD-EF	Certified as: Access	CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²

Table 2-6. Component Interoperability Test Summary (continued)

DSN Line Interfaces						
Interface	Component (See note 1.)	Status	Device Requirement	Test Results	Reference	Remarks
1000Base SX/LX 10/100/1000 BaseT	WS-C3560G-48PS-S, WS-C3560G-48PS-E, WS-C3560G-24PS-S, WS-C3560G-24PS-E, WS-C3560G-48TS-S, WS-C3560G-48TS-E, WS-C3560G-24TS-S, WS-C3560G-24TS-E, WS-C3560-8PC-S, WS-C3560-48PS-S, WS-C3560-48PS-E, WS-C3560-24PS-S, WS-C3560-24PS-E, WS-C3560-48TS-S, WS-C3560-48TS-E, WS-C3560-24TS-S, WS-C3560-24TS-E	Certified as: Access	CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²
1000Base SX/LX 10/100/1000 BaseT	WS-C3560E-24TD-S, WS-C3560E-24TD-E, WS-C3560E-48TD-S, WS-C3560E-48TD-E, WS-C3560E-24PD-S, WS-C3560E-24PD-E, WS-C3560E-48PD-S, <u>WS-C3560E-48PD-E</u> , WS-C3560E-48PD-SF, WS-C3560E-48PD-EF		CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²

Table 2-6. Component Interoperability Test Summary (continued)

DSN Line Interfaces						
Interface	Component (See note 1.)	Status	Device Requirement	Test Results	Reference	Remarks
1000Base SX/LX 10/100/1000 BaseT	WS-C2960-8TC-L, WS-C2960-24TC-L, WS-C2960-24TT-L, WS-C2960-48TC-L, WS-C2960-48TT-L, <u>WS-C2960G-8TC-L</u> , WS-C2960G-24TC-L, WS-C2960G-48TC-L, WS-C2960-24-S, WS-C2960-24TC-S, WS-C2960-48TC-S, WS-C2960PD-8TT-L		CoS Models	Met	UCR, Appendix 3, A3.3.3	
			Traffic Prioritization	Met	UCR, Appendix 3, A3.3.3.1	
			QoS	Met	UCR, Appendix 3, A3.3.4.1	
			Policing	Met	UCR, Appendix 3, A3.3.4.2	
			VLANs	Met	UCR, Appendix 3, A3.3.5	
			IEEE Conformance	Met	UCR, Appendix 3, A3.3.9.1	
			Reliability	Met	UCR, Appendix 3, A3.3.9.3.1	Reliability is a conditional requirement for a non-ASLAN. ²
			Network Management	Met	UCR, Appendix 3, A.3.3.4.2	Network Management is a conditional requirement for a non-ASLAN. ²
			Security	Met	UCR, Appendix 3, A.3.3.8	See note 3.
			IPv6	Met	UCR, Paragraph 1.7, and Appendix 3, A3.2.8	See note 4.
			TE	Met	UCR, Appendix 3, A.3.3.9.6	Redundant links are not required for a non-ASLAN. ²
LEGEND: 10/100/1000BaseT- 10/100/1000 Mbps (Baseband Operation, Twisted Pair) Ethernet ASLAN - Assured Services Local Area Network CoS - Class of Service DISA - Defense Information Systems Agency DISR - DoD Information Technology Standards Registry DoD - Department of Defense DSN - Defense Switch Network E - Enhanced IEEE - Institute of Electrical and Electronics Engineers IPv4 - Internet Protocol version 4 IPv6 - Internet Protocol version 6 JITC - Joint Interoperability Test Command Mbps - Megabits per second NEB - Network Equipment Building QoS - Quality of Service S - Standard TE - Traffic Engineering UCR - Unified Capabilities Requirements VLAN - Virtual Local Area Network WS - Workgroup Station						
NOTES: 1 Components bolded and underlined were tested by JITC. The other components in the family series were not tested; however, they utilize the same software and hardware and JITC analysis determined them to be functionally identical for interoperability certification purposes and they are also certified for joint use. 2 If a system meets the requirements for an ASLAN, it also meets the lesser requirements for a non-ASLAN. 3 Security is tested by DISA-led Information Assurance test teams and published in a separate report. 4 An IPv6 capable system or product, as defined in the UCR, paragraph 1.7, shall be capable of receiving, processing, and forwarding IPv6 packets and/or interfacing with other systems and protocols in a manner similar to that of IPv4. IPv6 capability is currently satisfied by a vendor Letter of Compliance signed by the Vice President of the company. The vendor must state, in writing, compliance to the following criteria: a. Conformance with IPv6 standards profile contained in the DISR. b. Maintaining interoperability in heterogeneous environments and with IPv4. c. Commitment to upgrade as the IPv6 standard evolves. d. Availability of contractor/vendor IPv6 technical support.						

12. TEST AND ANALYSIS REPORT. No detailed test report was developed in accordance with the Program Manager's request. JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Unclassified-But-Sensitive Internet Protocol Router Network (NIPRNet) e-mail. More comprehensive interoperability status information is available via the JITC System Tracking Program (STP). The STP is accessible by .mil/gov users on the NIPRNet at <https://stp.fhu.disa.mil>. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at <https://jit.fhu.disa.mil> (NIPRNet), or <http://199.208.204.125> (SIPRNet). Information related to DSN testing is on the Telecom Switched Services Interoperability (TSSI) website at <http://jitc.fhu.disa.mil/tssi>.